(P=0.019). The average control points in Agility and MLCi2 were 98.6 and 99.9, respectively, with no significant differences.

Conclusions: Agility allowed statistically significant improvements in both PTV coverages and rectum dose sparing compared with MLCi2. Although Agility showed statistically higher outputs probably because of smaller segments, this may not be an important issue in the clinical setting.

Poster: RTT track: Image guided radiotherapy, adaptive radiotherapy, geometric uncertainties and margins

PO-1108

Optimal planning target volume and image guidance policy for post-prostatectomy intensity modulated radiotherapy

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Purpose/Objective: There is limited information available on the optimal Planning Target Volume (PTV) expansions and image guidance methods for post-prostatectomy intensity modulated radiotherapy (PP-IMRT). Large uniform PTV margins aligned to bony anatomy are frequently used but irradiate a large volume of normal tissue. The aim of this study is to assess the impact of various PTV margin recipes with and without soft tissue matching.

Materials and Methods: The Cone Beam CT (CBCT) images (n=377) of 40 patients who received PP-IMRT with daily online alignment to bony anatomy (BA) were reviewed. Six different PTV expansions were assessed (see Table 1). Each PTV was assessed for size, bladder and rectum coverage and geographic miss with and without an averaged soft tissue (AST) match.

Results: The 0.5cm uniform expansion (median = 222.3cc) was the smallest and 1cm uniform (361.7cc) the largest. Table 1 outlines the percentage of rectum and bladder within the PTV as well as rates of geographic miss with and without AST matching. AST matching reduced the rate of geographic miss by half to two thirds depending on the PTV expansion. The AST matching technique reduces geographic miss rates to <10% for all PTV expansions. When using the smaller anisotropic PTV expansion, the geographic miss rate of 21.0% with BA matching would be reduced to 5.6% with AST matching.

Table 1: Results for each PTV

		PTV Name					
		0.5cm uniform	1cm uniform	1cm + 0.5cm posterior	NSCC	van Herk	Smaller Anisotropic
PTV expansion in upper prostate bed (cm)	Ant/Post	0.5/0.5	1/1	1/0.5	1.5/1	1.9/1.9	1/1
	Sup/Inf	0.5/0.5	1/1	1/1	1/0.5	1.1/1.1	0.5/0.5
	Left/right	0.5/0.5	1/1	1/1	1/1	0.5/0.5	0.5/0.5
PTV expansion in lower prostate bed (cm)	Ant/Post	0.5/0.5	1/1	1/0.5	0.8/0.8	0.7/0.7	0.5/0.5
	Sup/Inf	0.5/0.5	1/1	1/1	0.8/0.8	0.7/0.7	0.5/0.5
	Left/Right	0.5/0.5	1/1	1/1	0.8/0.8	0.4/0.4	0.5/0.5
Rectum inside the PTV (%)		10.2	25.0	15.0	20.0	36.0	16.6
Bladder inside the PTV (%)		17.1	25.8	25.7	26.4	28.0	19.3
Geographic miss rate using bony matching (%)		28.4	8.0	15.6	9.3	4.2	21.0
Geographic miss rate using soft tissue matching (%)		9.8	4.0	5.8	3.2	N/A	5.6

Abbreviations: NSCC = blinded add after review, PTV = planning target volume, N/A = not applicable.

Conclusions: The optimal image guidance policy for PP-IMRT is daily AST matching using CBCT scans with a small anisotropic PTV expansion. Caution must be taken during online matching to ensure adequate training of the Radiation Therapists performing this procedure.

PO-1109

Which optimal fiducial marker for image guidance in prostate radiotherapy treatment?

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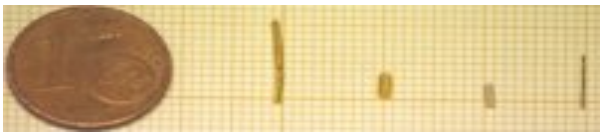
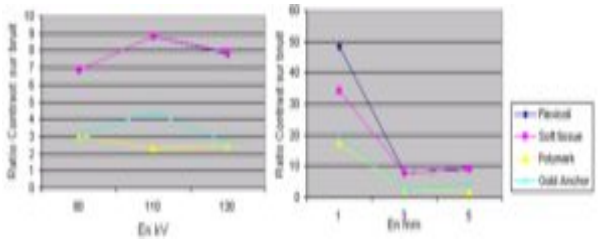
Purpose/Objective: In a context of prostate cancer treatment, we introduced daily kV imaging since five years. IGRT feed back loop clearly demonstrated that PTV margins currently used are consistent with daily bone registration but can not be reduced without changing our practice. IGRT based on radio opaque markers registration is a compulsory step before reducing PTV margin and dose escalation. The choice of optimal fiducial markers is important because artifact and poor localization should have consequences on accuracy of treatment.

Materials and Methods: We compared different radio-opaque markers : PolyMark (1,0mm diameter, 3mm long, - polymer marker Civco), Soft tissue gold marker (1,2mm diameter, 3mm long - gold marker Civco), Flexicoil (0,9 mm diameter,10 mm long - gold marker Civco) and Gold Anchor, (0,5 mm diameter, 10 mm long - gold marker Gold Anchor).

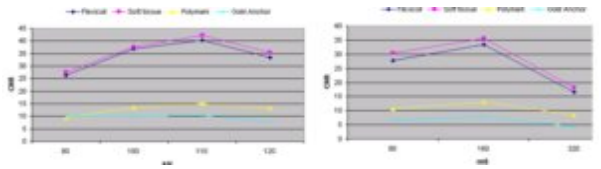


Characteristics such as contrast noise ratio, partial volume effect, artifact have been studied on different imaging modalities (CT, MRI, MV and kV). Then treatment has been simulated on anthropomorphic phantom and inter-operator variability of fiducial markers registration versus bone registration has been analyzed.

Results: Radio-opaque registration would significantly reduce margins while ensuring good coverage of PTV. Nevertheless markers show differents characteristics for imaging as below:
CNR CT imaging

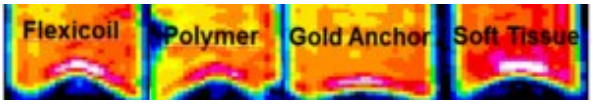


CNR for kV imaging

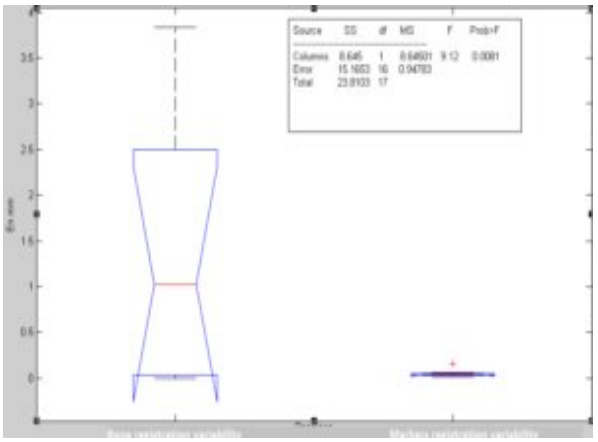


MV Imaging

MRI imaging



Polymer and Gold Anchor markers show high and sharp contrast with less artifact for most imaging system but can not be used with an As500 MV imaging system. Although we need to adjust our IGRT protocol, they present the best characteristics for our practice. Furthermore, we reduced inter observer variability.
Standard deviation vector of registration is 1.9 mm on bones matching and 0.1 mm on markers matching.



Conclusions: Choice of fiducial markers depends on IGRT systems and protocols we use. It might be necessary to adopt new IGRT procedures.

	CT			KV	MV	MRI	DOSIMETRY
	CNR	PARTIAL VOLUME	ARTIFACTS	CNR	CNR	CNR	HOT SPOT
POLYMARK	-	-	+	+	-	++	++
SOFT TISSUE	+	-	-	++	+	-	-
FLEXICOIL	+	+	-	++	+	-	-
GOLD ANCHOR	-	++	+	+	-	+	+

Futhermore, fiducial markers registration clearly increase accuracy of treatment and reduce inter-operator variability.

PO-1110

Clinical experience with a radiofrequency system for setup and motion monitoring of prostate radiotherapy

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Purpose/Objective: To test the Calypso radiofrequency in its accuracy and reliability in prostate matching, in comparison to cone beam CT imaging. To use Calypso's tracking system in order to account for prostate motion, in preparation for future prostate SBRT treatments. To use Calypso in place of daily kv-kv imaging.
Materials and Methods: Two patients have been treated thus far, using our new Calypso system. They were treated with IMRT arc therapy, to a standard total dose of 76.2Gy, 2.31Gy per Fraction. Prior to treatment planning, the patients were selected to be implanted with 3 Calypso transponders, with the same criteria of Goldmarker implementation, with the added limitation that the abdomen may not be more than 17cm from the prostate. The Calypso system can monitor patient motion in three dimensions. At the Calypso tracking station, prostate motion tolerances were set to 0.5cm in all directions except in the anterior direction, which was limited to 0.3cm in order to avoid rectal irradiation. Should the prostate position exceed the set limits, then the beam would be automatically held. For treatment, the patients were aligned on the treatment table to their tattoos, and the